

WHAT IS CLAIMED IS

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Sub A1

1. A magnetic recording medium comprising:
at least one exchange layer structure, and
a magnetic layer formed on said exchange layer
10 structure,
said exchange layer structure comprising:
a ferromagnetic layer; and
a non-magnetic coupling layer provided on
said ferromagnetic layer and under said magnetic
15 layer,
said ferromagnetic layer and said magnetic
layer having antiparallel magnetizations.

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2. The magnetic recording medium as
claimed in claim 1, wherein said ferromagnetic layer
is made of a material selected from a group
25 consisting of Co, Ni, Fe, Ni-based alloys, Fe-based
alloys, and Co-based alloys including CoCrTa, CoCrPt
and CoCrPt-M, where M = B, Mo, Nb, Ta, W or alloys
thereof.

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3. The magnetic recording medium as
claimed in claim 1, wherein said ferromagnetic layer
35 has a thickness in a range of 2 to 10 nm.

Sub A2 4. The magnetic recording medium as
claimed in claim 1, wherein said non-magnetic
coupling layer is made of a material selected from a
group of Ru, Rh, Ir, Ru-based alloys, Rh-based
5 alloys, and Ir-based alloys.

10 5. The magnetic recording medium as
claimed in claim 1, wherein said non-magnetic
coupling layer has a thickness in a range of 0.4 to
0.9 nm.

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Sub A3 6. The magnetic recording medium as
claimed in claim 1, wherein said magnetic layer is
20 made of a material selected from a group of Co, and
Co-based alloys including CoCrTa, CoCrPt and CoCrPt-
M, where M = B, Mo, Nb, Ta, W or alloys thereof.

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7. The magnetic recording medium as
claimed in claim 1, which further comprises:
a substrate; and
30 an underlayer provided above said substrate,
said exchange layer structure being provided
above said underlayer.

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Sub A4 8. The magnetic recording medium as

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claimed in claim 7, which further comprises:

a non-magnetic intermediate layer interposed between said underlayer and said exchange layer structure,

5 said non-magnetic intermediate layer having a hcp structure alloy selected from a group of CoCr-M, where M = B, Mo, Nb, Ta, W or alloys thereof, and having a thickness in a range of 1 to 5 nm.

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9. The magnetic recording medium as claimed in claim 8, which further comprises:

15 a NiP layer interposed between said substrate and said underlayer, said NiP layer being mechanically textured or oxidized.

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sub A5 10. The magnetic recording medium as claimed in claim 7, wherein said underlayer is made of a B2 structure alloy selected from a group of 25 NiAl and FeAl.

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11. The magnetic recording medium as claimed in claim 1, which comprises at least a first exchange layer structure and a second exchange layer structure interposed between said first exchange layer structure and said magnetic layer, wherein a 35 ferromagnetic layer of said second exchange layer structure has a magnetic anisotropy lower than that of a ferromagnetic layer of said first exchange

layer structure, and magnetizations of the ferromagnetic layers of said first and second exchange layer structures are antiparallel.

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12. The magnetic recording medium as claimed in claim 1, which comprises at least a first 10 exchange layer structure and a second exchange layer structure interposed between said first exchange layer structure and said magnetic layer, wherein a product of a remanent magnetization and thickness of a ferromagnetic layer of said second exchange layer 15 structure is smaller than that of a ferromagnetic layer of said first exchange layer structure, and magnetizations of the ferromagnetic layers of said first and second exchange layer structures are antiparallel.

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13. A magnetic storage apparatus 25 comprising:
at least one magnetic recording medium including at least one exchange layer structure, and a magnetic layer formed on said exchange layer structure; and
30 at least one head recording information on and/or reproducing information from the recording medium,
said exchange layer structure comprising:
a ferromagnetic layer; and
35 a non-magnetic coupling layer provided on said ferromagnetic layer and under said magnetic layer.

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said ferromagnetic layer and said magnetic layer having antiparallel magnetizations.

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14. The magnetic storage apparatus as claimed in claim 13, wherein said ferromagnetic layer is made of a material selected from a group 10 consisting of Co, Ni, Fe, Ni-based alloys, Fe-based alloys, and Co-based alloys including CoCrTa, CoCrPt and CoCrPt-M, where M = B, Mo, Nb, Ta, W or alloys thereof.

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15. The magnetic storage apparatus as claimed in claim 13, wherein said ferromagnetic 20 layer has a thickness in a range of 2 to 10 nm.

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16. The magnetic storage apparatus as claimed in claim 13, wherein said non-magnetic coupling layer is made of a material selected from a group of Ru, Rh, Ir, Ru-based alloys, Rh-based alloys, and Ir-based alloys.

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17. The magnetic storage apparatus as 35 claimed in claim 13, wherein said non-magnetic coupling layer has a thickness in a range of 0.4 to 0.9 nm.

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18. The magnetic storage apparatus as
claimed in claim 13, wherein said magnetic layer is
made of a material selected from a group of Co, and
Co-based alloys including CoCrTa, CoCrPt and CoCrPt-
5 M, where M = B, Mo, Nb, Ta, W or alloys thereof.

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